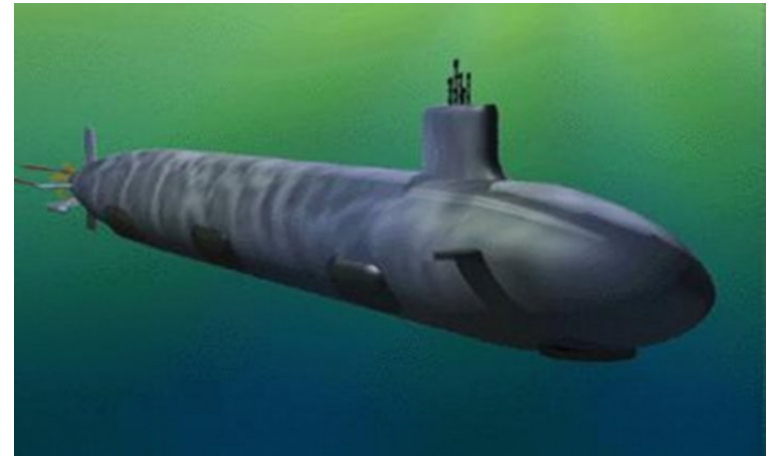




O&S Cost Growth



Background

- Acquisition cost growth grabs headlines (e.g., VH-71, LCS)
- But operating and support costs typically account for about two-thirds of the life-cycle costs of a weapon system—growth in O&S costs is also a serious problem that deserves more attention

DefenseNews.com, *U.S. Navy Operations Chief: Cutting Costs is the Key*, by Philip Ewing, January 14, 2009 reports,

“[CNO] has been studying the operating costs of the Navy’s latest ships, and the prospect of high fuel and operating costs decades from now ‘**scares the heck out of me**’ ”

GovExec.com, ***Top Admiral Affirms Commitment To 313-Ship Fleet***, by Katherine McIntire Peters, September 15, 2009 reports,

“Roughead said it is critical that the Navy do a much better job of estimating operating costs -- including the personnel costs associated with weapons systems -- over the lifetime of its ships and other major procurements.”

Outline

- Study overview
- Findings
 - Scope of the problem and general findings
 - Case studies
 - F/A-18E/F
 - MH-60S
 - SSN-774
 - Potential problem areas
- Recommendations

Issue and task for initial study

- Sponsor: OPNAV N81 (Assessment Division)
- Issue: *Actual* program Operating and Support (O&S) costs are *radically exceeding estimates* being performed during the AoAs
- Question: *Why?* (regardless of the sources)
- Study task: Analyze the initial cost estimates of the O&S life-cycle components. The goal is to produce an assessment of current costing methodology and *provide insight for decision makers on potential problem areas and how to take preventative measures to avoid them.*

Study approach

- Initial direction was to conduct four case studies and draw conclusions from them
- We have taken the “hi-lo” mix approach (as approved by sponsor)
 - Analyzed three of the original four programs in detail
 - F/A-18E/F
 - MH-60S
 - SSN-774 (did not interview, but collected data)
 - LPD-17 (decided not to pursue because the program is still too new)
 - Examined additional major Navy ship and aircraft programs in lesser detail—but in sufficient degree for us to draw some general conclusions
- Our focus ended up comparing “initial” to “final” estimates
 - None of the three cases conducted formal AoAs
 - We did not attempt to obtain and analyze AoAs for the other programs—that would have been very time-consuming
 - Did not use actual costs (from VAMOSOC), because they typically do not represent a steady-state
 - Hence not comparable with the initial estimates of the total O&S costs

Metric we used for cost “growth”

- Similar in principle to measuring acquisition cost growth
- Growth = $(\text{cost}_f - \text{cost}_i) / (\text{cost}_i)$
 - cost_f , cost_i are both estimates from the initial and the final (latest) SARs
 - we present both total growth and the annualized growth
- Adjusted for inflation and “quantity”
 - used NCCA inflation indices (if the initial and the final estimates are presented in different year dollars)
 - normalized to a base unit (i.e., per aircraft or squadron, per ship)
 - normalized for differences in utilization between the initial and the final estimates (applicable to O&M portion only)

Programs examined

Ship programs (15)

- AOE 6
- CVN 21
- CVN 74/75
- CVN 76
- CVN 77
- DDG 51
- LHD 1
- LPD-17
- LSD -49
- MHC-51
- SSN-21
- **SSN-774**
- Strategic sealift
- T-AKE
- T-AO 187

Aircraft programs (11)

- C/MH-53E
- E-2D AHE
- EA-18G
- F/A-18C/D
- **F/A-18E/F**
- F-14D
- MH-60R
- **MH-60S**
- P-8A
- SH-60F
- V-22

Scope of the problem and general findings

- O&S cost growth problem has been a persistent issue
- Average “growth” from initial O&S cost estimate to latest estimate is 15 percent
 - Represents growth of 2 percent per year
 - Many programs still ongoing
- Aircraft programs experienced higher O&S cost growth than the ship / submarine programs
- Changes in flyaway cost (an indication of requirements creep) affect O&S cost
- The biggest “problem” category appears to be aircraft O&M
- Some components of O&M costs (DLR and consumables) experienced higher cost increase than O&M deflator

Average “growth” in O&S costs

Average cost delta from initial to final estimates^{1,2,3}

	All programs	Ships	Aircraft
O&S delta	15% (1.9%)	6% (0.8%)	27% (3.1%)
Personnel delta	17% (2.1%)	21% (2.7%)	13% (1.6%)
O&M delta	19% (2.3%)	1% (0.1%)	42% (4.5%)

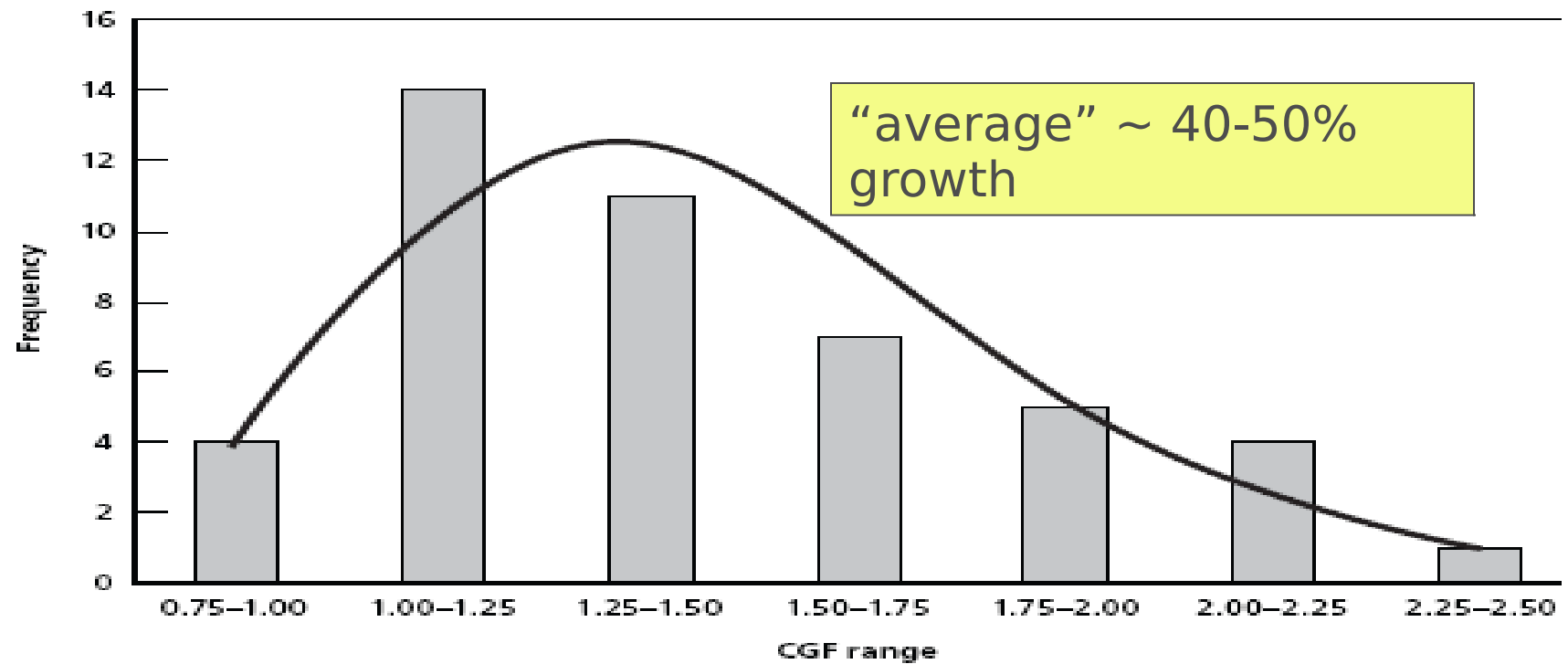
1. Average is not weighted by size of the program—that causes some distortion when looking at particular O&S component by program type
2. Numbers in parentheses are average annual cost growth
3. All figures are adjusted for inflation, flight hours, and number of aircraft per squadron as appropriate

O&S cost growth in context

- Not exactly comparable, but useful to put O&S cost growth in general context

Figure 4.1

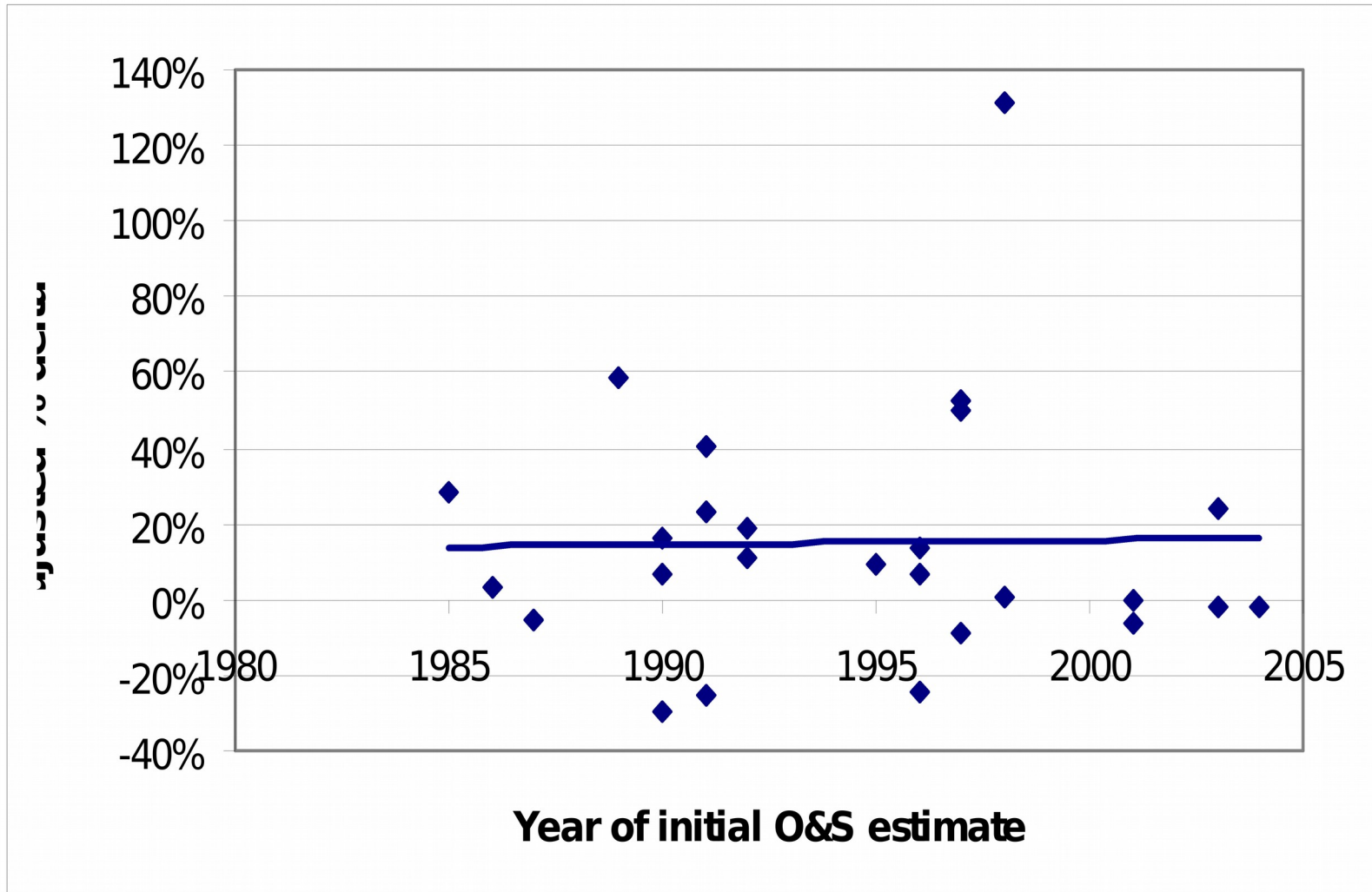
Distribution of Total Cost Growth from MS II Adjusted for Procurement Quantity Changes



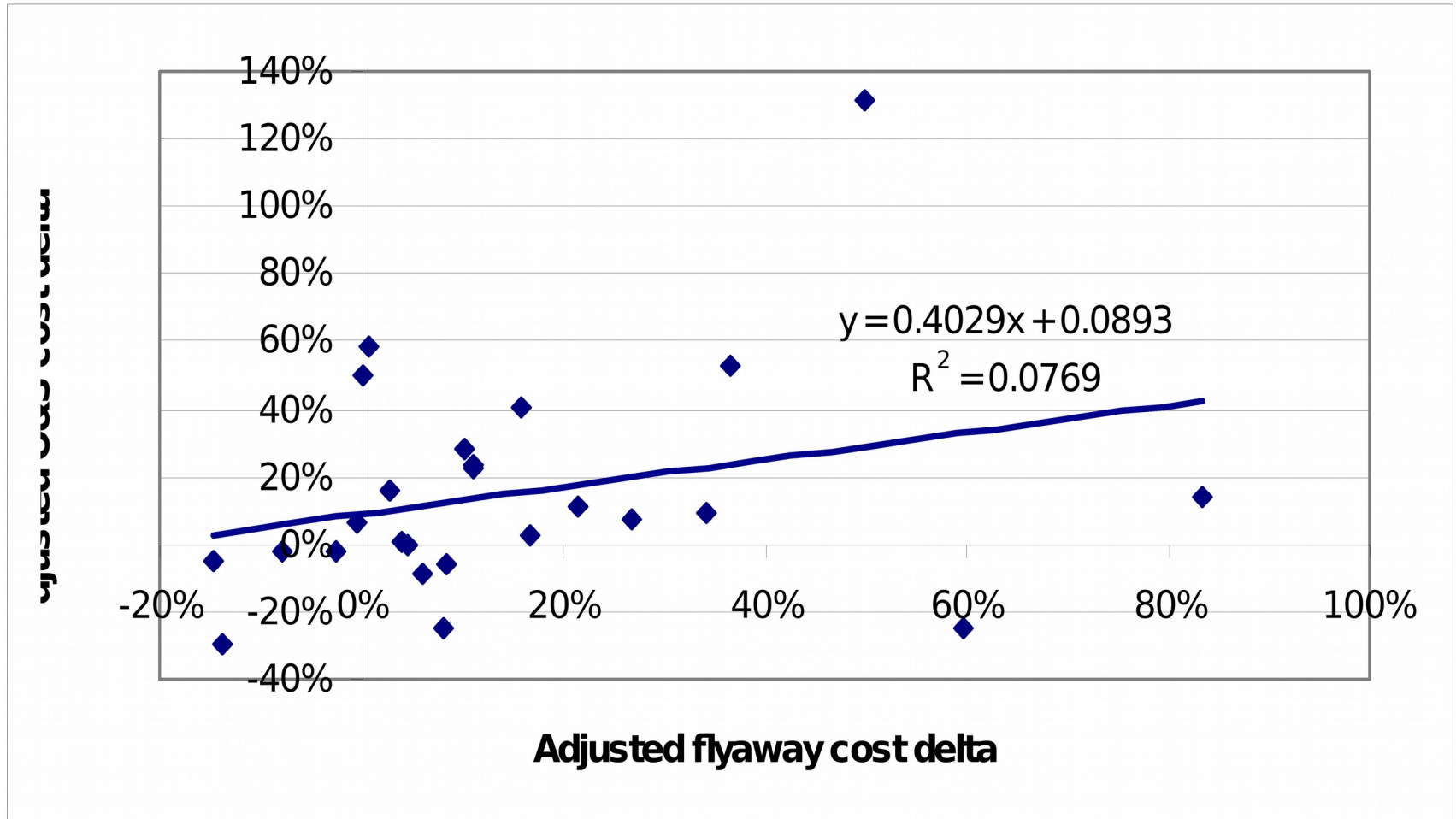
RAND TR345-4.1

Historical Cost Growth of Completed Weapon System Programs, 2006

O&S cost estimates don't appear to get better or worse

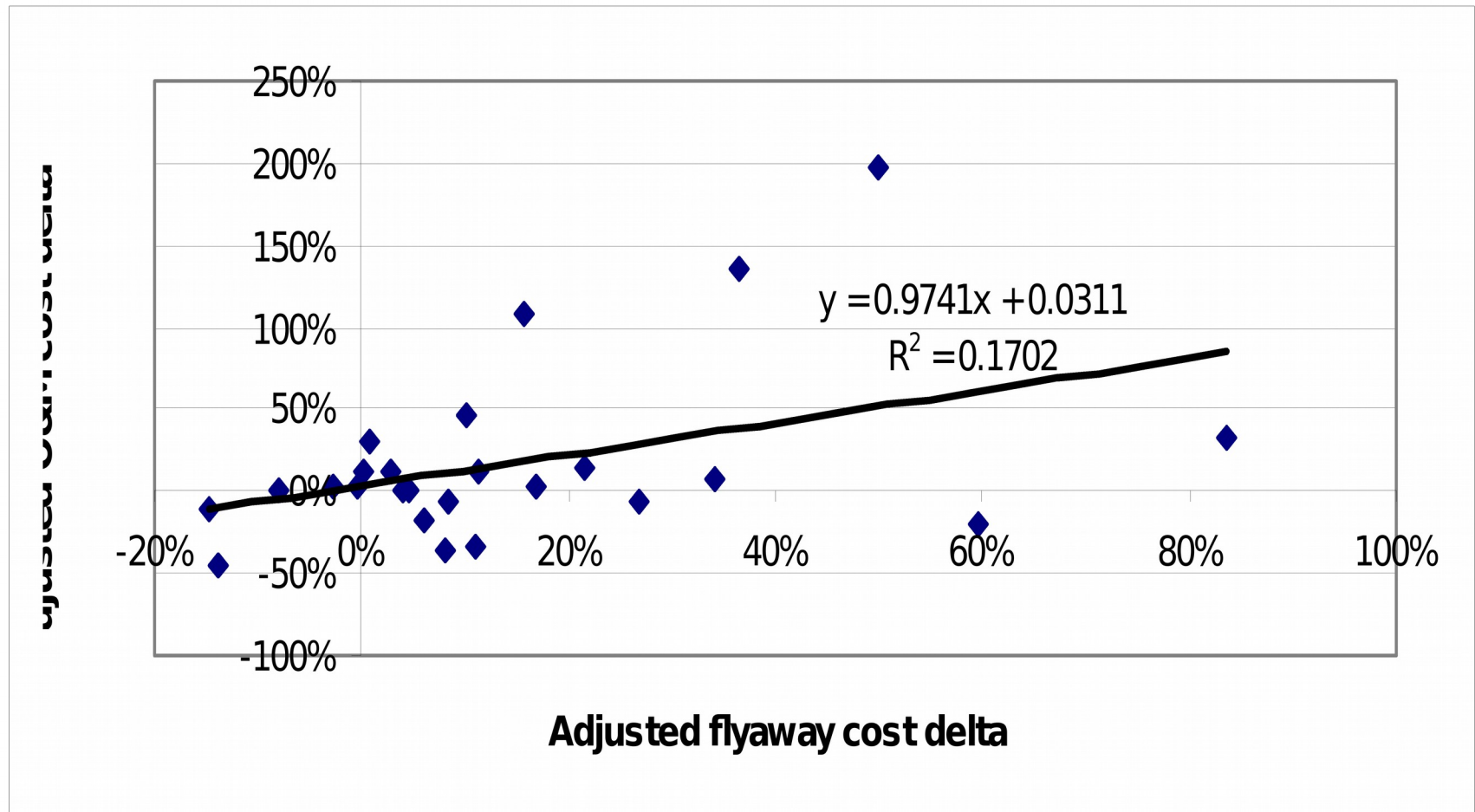


Changes in flyaway costs seem to affect O&S costs



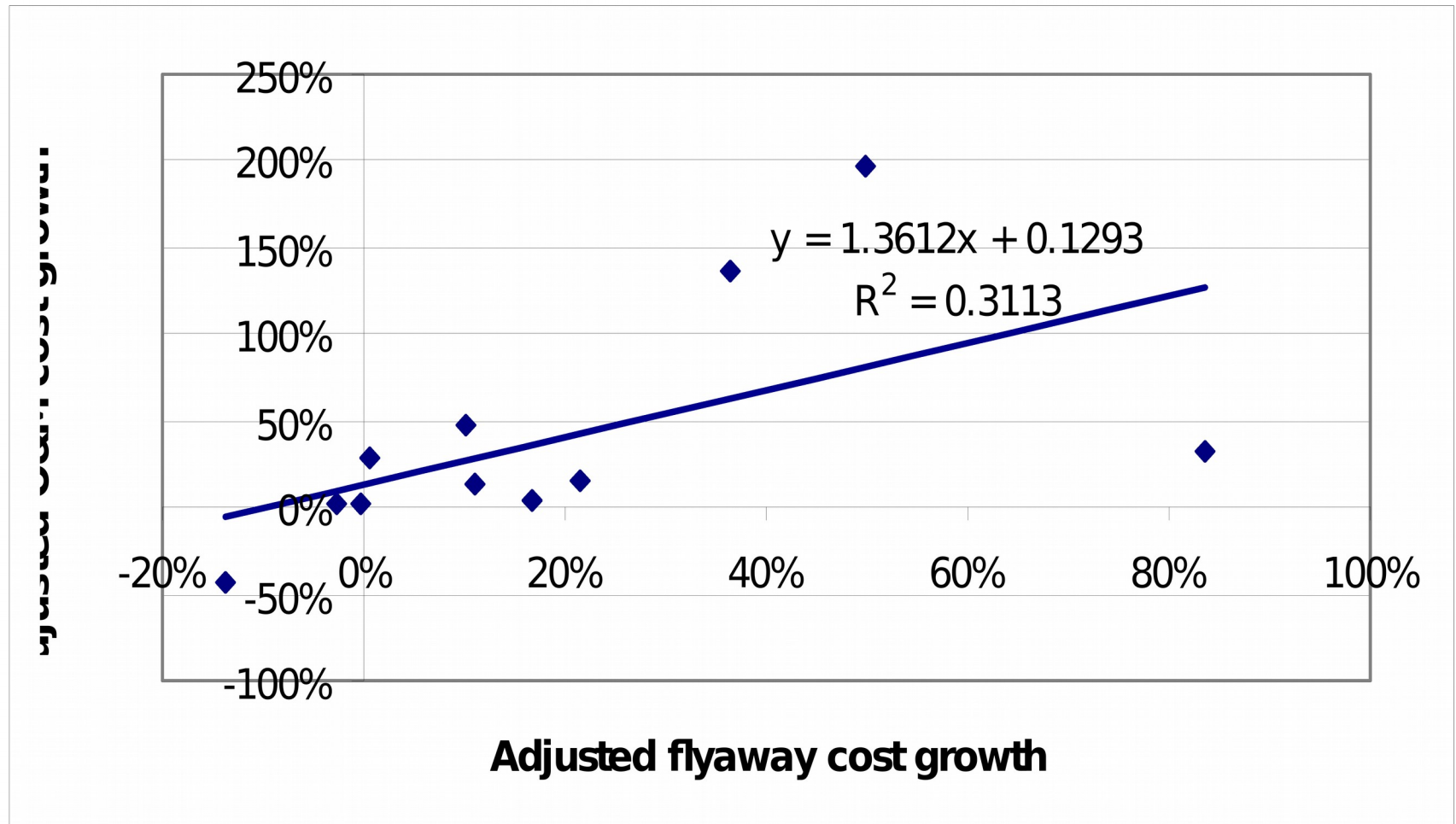
Explanatory variable not significant

Changes in flyaway costs seem to affect O&M costs more



Explanatory variable significant at .05 level

Changes in flyaway costs seem to affect aircraft O&M costs the most



Explanatory variable significant at .10 level

Cross-section equation for platform-related O&M*

Other studies also indicated the relationship between the O&M cost and the value of the platform (e.g., flyaway cost). Coefficient varies depending on the data set and the model specification.

$$\text{O\&M} = (1 + .090) * V^{.73} N^{.83} \text{age}^{(.55\text{air} + .24\text{Navy})}$$

All variables are in ratios FY02/FY93

V is value per platform

N is number of platforms

age is calendar age in years

OpTempo did not come in

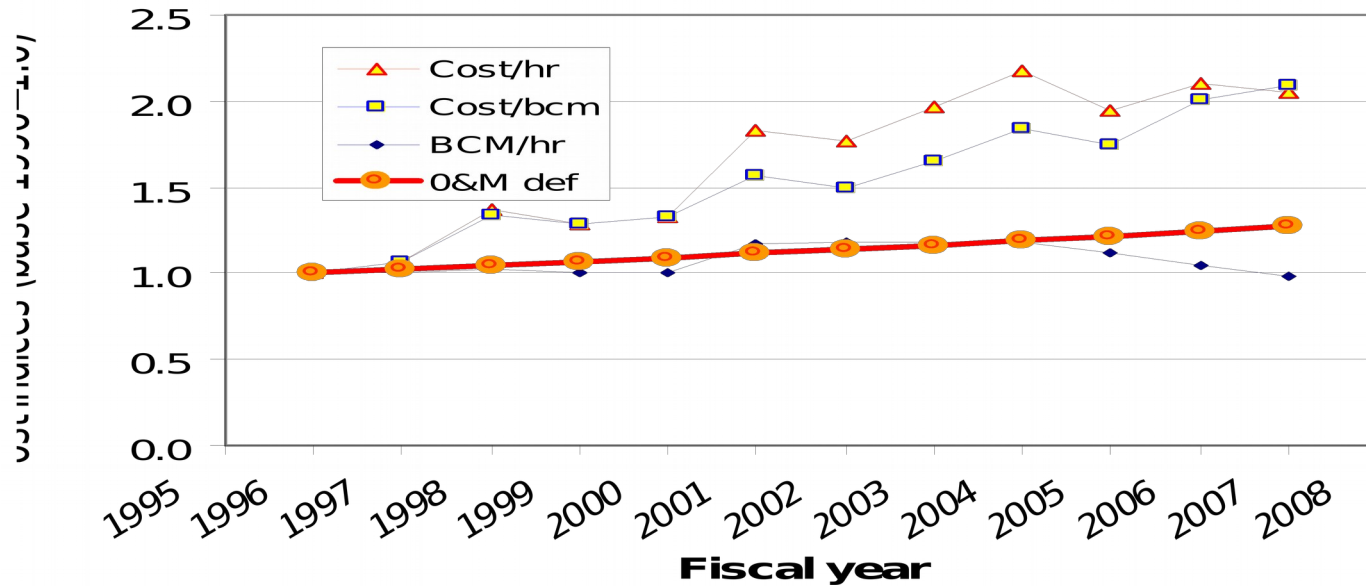
Air takes value 1 for aircraft

Navy takes value 1 for carrier aircraft

Based on 15 observations (10 Air Force, 3 Navy, 1 USMC, 1 Army)

* James Jondrow, et al, *Explaining and Forecasting O&S Costs*, CNA document D0010406, Sep 2004

DLR cost per BCM exceeded O&M deflator



- Cost/hour grew about 7.1% per year
- Price = Cost/BCM grew about 6.4% per year
- Price growth not associated with new platforms was about 60% of this or 3.8%
- The O&M deflator grew about 2.2% per year
- Over 15 years, forecasting price (cost/BCM) using the O&M deflator would lead to an overrun of more than 25%

Findings from case studies:

main reasons cited for changes in estimates

	F/A-18 E/F ✓	MH-60S ✓	SSN-774*
New capabilities (“requirements creep”)	✓		
New operating philosophy	✓		
Higher utilization	✓	✓	
Changes in size (manning, squadron size, number of aircraft)			
Incorrect price forecast (foreseeable or unforeseeable)	✓	✓	✓
Military personnel	✓	✓	
Parts (AVDLR and consumables)	✓	✓	
Accounting change (BOS)	✓	✓	✓
Estimation method (error or outdated model)			

* Did not interview the program office — findings are based on analysis of data/model provided by PM

Drivers of the F/A-18E/F cost growth*

- SAR 2007 estimate exceeds SAR 1992 (MS II) estimate by 38 percent
- Overall, known factors account for 87 percent of growth
- Key drivers are
 - AVDLR/AFM cost growth above commodity-price inflation: 30 percent of delta
 - New manpower cost (MEHRC): 10 percent of delta
 - New capabilities/modifications added since MSII: 19 percent of delta
 - New method for calculating indirect costs (BOS): 13 percent of delta
- Some cost estimates have been reduced:
 - Depot savings due to maintenance concept changes: (negative) 15 percent of delta
- “Errors” do not appear significant: 7-10 percent of delta

* AIR-4.2 and program office personnel provided detailed accounting of cost discrepancy between the 1992 and 2007 O&S cost estimates

Overall lessons

- There are some commonalities among the 3 programs that explain the majority of the cost increases
 - Increasing requirements
 - Incorrect price forecasts
 - notably additional MEHRC costs and AVDLR and consumables cost increases above inflation
 - Accounting changes that allocate more of the indirect costs to platforms
 - notably additional BOS costs
- Program offices offered other reasons without quantifying their effects, and we could not independently assess them as a part of this study
 - Changes in squadron structure (e.g., difficult to compare a “normal” squadron vs. one with detachments—presumably smaller, more fragmented squadrons would incur higher O&S costs per aircraft, but the exact effects are unknown)
 - Platforms pushed out to fleet too early (implies the process is not yet “optimal,” hence more costly, but the exact effects are unknown)
 - Changes in use of performance-based logistics (studies on PBL are inconclusive about its effects on cost)
 - Additional training requirements (related to changes in requirements or utilization, but the exact effects are unknown)

Summary of findings

- O&S cost growth problem has been a persistent issue
- Average “growth” from initial O&S cost estimate to latest estimate is 15 percent
 - Represents growth of 2 percent per year
- The biggest “problem” category appears to be aircraft O&M
- Major drivers for cost growth include:
 - Increasing requirements
 - Changes in price forecasts
 - Moving to new estimation/accounting methods or correcting errors in old methods
 - Cost estimation, per se, did not appear to be a major driver
- Issues with estimating method include:
 - Aircraft programs relied heavily on analogy
 - SSN-774 program relied on CERs, but there were issues

Study uncovered potential problem areas

- Inadequate or improper use of CERs
- Inconsistent reporting and availability of data
- Deflators underestimating prices
- Not incorporating foreseeable changes into cost estimates

Recommendations

- Use CERs more often in generation of (*initial*) O&S cost estimates
 - Potentially improve accuracy of estimation over analogy
 - Help stakeholders better understand the implications of changes in cost drivers on O&S cost
 - Inform leadership on implications of added capabilities
 - Force better interaction between cost analysts and other specialists
 - Require development of CERs
 - Top-level CERs would allow independent assessment of detailed program office/SYSCOM estimates
- Develop standard reporting structure
 - Report costs on a standard basis, i.e., annual costs per aircraft (ship)
 - Provide the same minimum set of assumptions and reasons for change
 - Would allow better cost visibility for understanding, comparison, and management
- Examine whether “official” inflation forecasts systematically underestimate actuals
 - If appropriate, allow waivers to use deflators more accurate than the ones prescribed by OMB/OSD